Reconstruction of marine organic carbon content in the Japan Sea sediments from Br variability measured by XRF core scanner

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Quaternary hemipelagic sediments in the Japan Sea have distinct dark and light layers. These alternations of dark and light layers are associated with Dansgaard-Oeschger cycles (Tada et al., 1999). Previous studies focused on the last 200 kyr and showed that dark layers are rich in organic matter compared to light layers, and organic matter is a main cause of dark color of the sediments (Tada et al., 1999; Nakajima et al., 1998). Also, as marine organic matter content in the sediments reflect surface productivity and ocean redox conditions, a hypothesis was proposed that intensity of East Asian Summer Monsoon (EASM) rainfall control formation of organic rich dark layers (Tada et al., 1999; Tada, 2012). Therefore, organic matter content in the Japan Sea sediment deposited in older ages provide us useful information about EASM variability in the Quaternary.
In the summer of 2013, IODP Exp. 346 Asian Monsoon drilled at seven sites in the Japan Sea, and obtained long hemipelagic sediment cores back to entire Quaternary (Tada et al., 2015). Alternations of distinct dark and light layers existed for last 1.5 Myr (Tada et al., 2015). Reconstruction of organic matter content from these alternations of dark and light layers will provide us useful paleoclimate information, however, analysis of organic matter content for more than several hundred dark layers are not realistic.
In this study, we use bromine (Br) content for estimation of marine organic matter content in the Japan Sea sediment. Br is concentrated in marine plankton (Masuzawa et al., 1988), and thus correlations between bromine content and total organic carbon (TOC) content in the sediments are reported (Ziegler et al., 2008). Furthermore, since Br concentration is higher in marine organic matter than terrestrial organic matter (Berg and Solomon, 2016), Br is proposed as a proxy for marine organic carbon (MOC) (Ziegler et al., 2008). However, this possibility is not verified.
In this study, we analyzed TOC and carbon isotope in the Japan Sea hemipelagic sediments recovered from Sites U1424 and U1425 during IODP Exp. 346. Since carbon isotope reflects ratios of marine and terrestrial organic matter, we calculate MOC from TOC and carbon isotope results. We also measure Br content in the same sediment using XRF core scanner (ITRAX) in Kochi University, Japan.
The results show good correlation between MOC and Br content. Therefore, Br could be used as a proxy to estimate MOC in the Japan Sea sediments.
Br variability measured by ITRAX in ~50yr resolution shows same variation with oxygen isotope record obtained from Chinese speleothem (Cheng et al., 2016) during last glacial period. Thus, estimated MOC variability record will provide us useful information to discuss about variability of EASM rainfall during the last 1.5 Myr.

Keywords: XRF core scanner, the Japan Sea, the Quaternary, marine organic matter, bromine (Br), IODP Exp. 346

